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The Commercial Technology and Regional Development Program at the Jet Propulsion Laboratory

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California Institute of Technology
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Agenda

- Characterization of the Jet Propulsion Laboratory
- Description of the Commercial Technology and Regional Development Program at JPL
- Commercialization Mechanisms
- Performance Metrics
- Examples of Successful Technology Partnering with Industry
- Examples of Company Partners

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The Jet Propulsion Laboratory

A Federally Funded Research and Development Center (FFRDC)

- FFRDC's were created from the 1940's to:
  - Establish non-advocate entities with a special relationship with their sponsors
  - Meet special long-term research or development needs
  - Be managed by a university, consortium of universities, or other non-profit organization
  - Develop long-term relationships between the government and the FFRDC
  - Examples are:
    - Argonne National Laboratory
    - Jet Propulsion Laboratory
    - Lawrence Livermore National Laboratory
    - Lincoln Laboratory
    - Los Alamos National Laboratory
    - Oak Ridge National Laboratory

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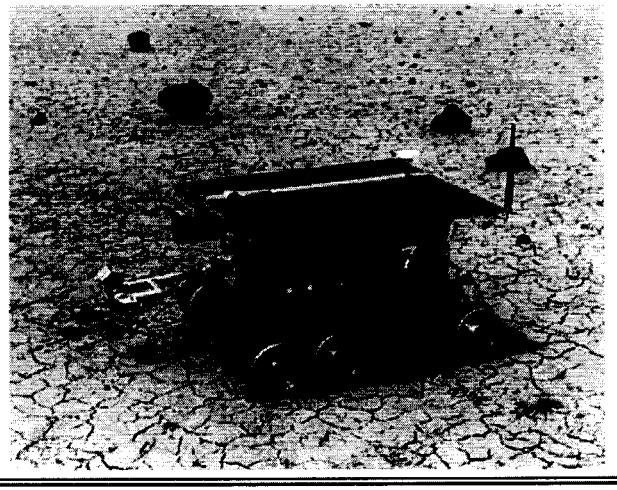
Jet Propulsion Laboratory Mission

- Enable the Nation, as part of the NASA team, to explore space for the benefit of humankind by developing robotic space missions to:
  - Explore our own and neighboring planetary systems
  - Search for life beyond the confines of Earth
  - Further the understanding of the universe and the fundamental laws that govern its evolution
  - Understand the dynamics of our own planet
- Apply our special capabilities to technical and scientific problems of national significance



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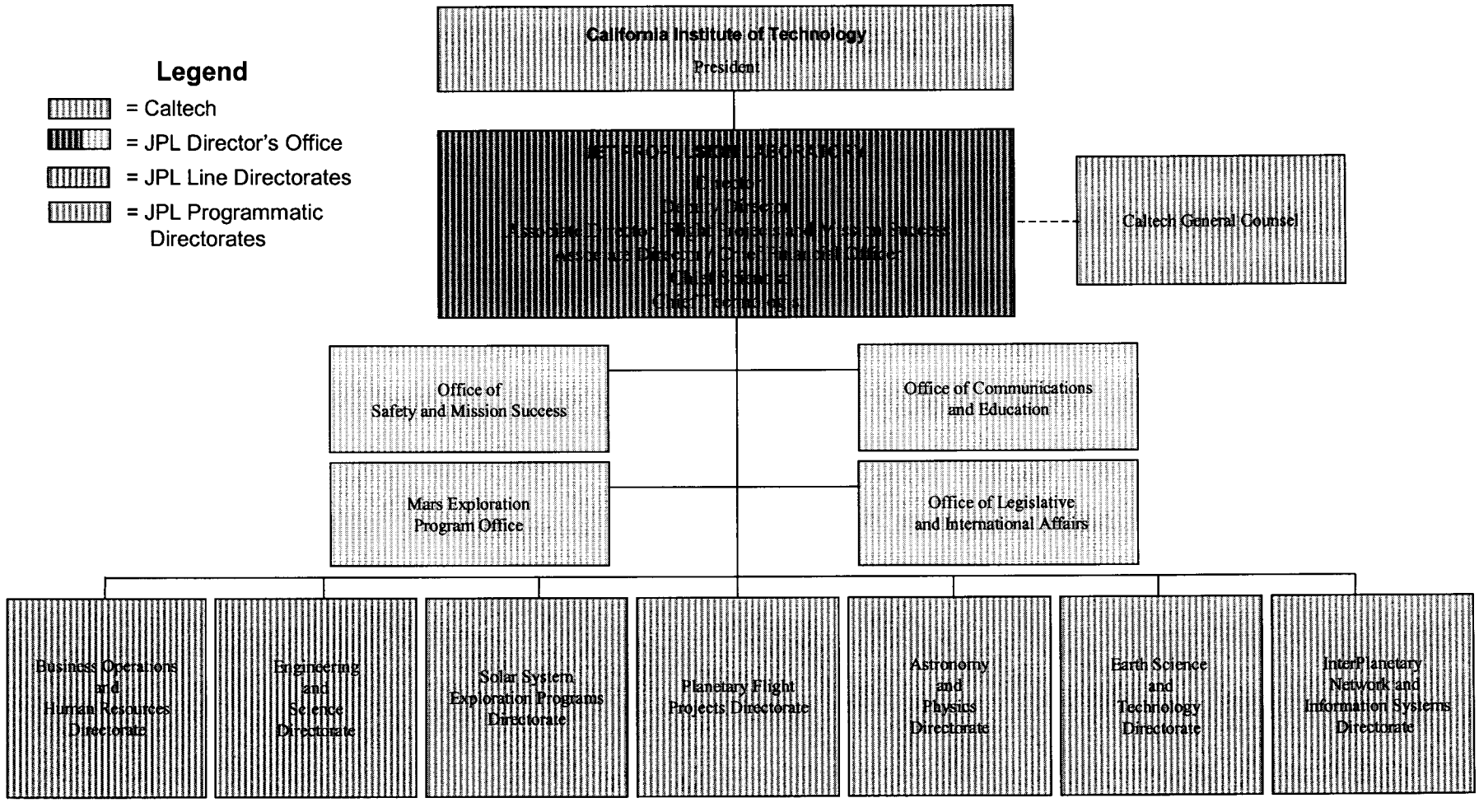
Jet Propulsion Laboratory Organization



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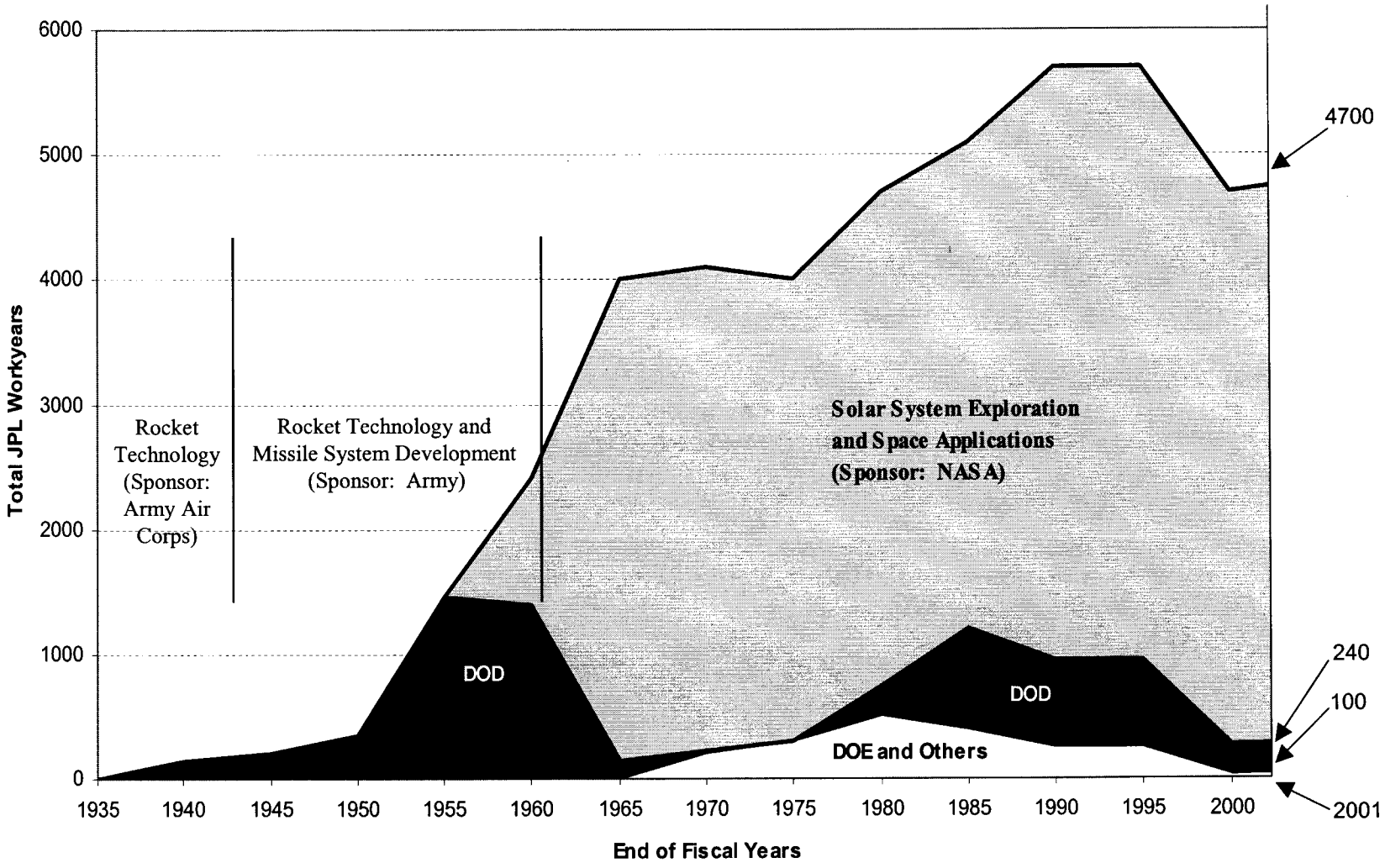
JPL Workforce Staffing History (Quota Workyears)



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Technical Division Competencies

Systems

- Mission design
- Navigation
- Systems analysis and engineering
- Spacecraft systems design
- Mission operations systems design
- End-to-end information systems design
- Operations research
- Economics

Telecommunications Science and Engineering

- Telecommunications systems engineering
- Information and communication theory
- Microwave remote sensing
- RF and optical transmitters and receivers
- Antennas
- Electromagnetic wave theory
- Radio astronomy and GPS geodynamics, and metric tracking research
- Planetary radar
- Digital signal processing
- Satellite and wireless communications

Mechanical Systems Engineering and Research

- Mechanical systems
- Structures and mechanisms
- Dynamics analysis
- Materials
- Mobility systems
- Environmental tests
- Thermal and fluid systems
- Computer-Aided Design (CAD)
- Propulsion and pyrotechnics
- Biotechnology
- Chemistry and chemical systems
- Gossamer systems
- Microgravity sciences
- Mechanical fabrication

Observational Systems

- UV/VIS/IR imaging/spectrometry systems
- Microwave/submillimeter systems
- Optical/submm wave interferometry systems and technology
- In-situ instruments and technology
- Advanced visible IR/submillimeter detector/sensor technologies
- Laser remote sensing
- Advanced optics technology
- Mission/instrument/optical modeling and simulation
- Science/system data analysis and visualization technology
- Planetary data systems
- Database management technology

Earth and Space Sciences

- Remote sensing and in-situ flight experiments
- Laboratory chemistry and physics
- Planetary astronomy
- Astrobiology
- Astrophysics/Origins
- Earth and planetary atmospheres
- Earth and planetary geoscience
- Oceanography
- Asteroids, comets and satellites
- Space physics

Avionic Systems and Technology

- Guidance and control
- Integrated space microavionic systems
- Engineering sensors, actuators for control and precision metrology
- Power systems
- Rovers, robotics, machine vision
- Science sensors, microelectromechanical, and microinstruments
- Neural networks, fuzzy logic, and algorithms
- Photonics, electro-optics, and optical processing
- Systems autonomy
- Mission operations support

Information Technologies and Software Systems

- Spaceflight and instrument operations
- Mission software systems
- Mission data management
- Software engineering standards and technology
- Institutional infrastructure services and contract management
- Information systems engineering
- Data management and information extraction
- Digital communications systems and computer networks
- Computer graphics and system visualization
- Artificial intelligence and operations automation
- Autonomy architecture and software
- Simulation systems
- Command and control systems
- Secure communication
- Intelligent synthesis environment
- Quantum computing
- Supercomputing

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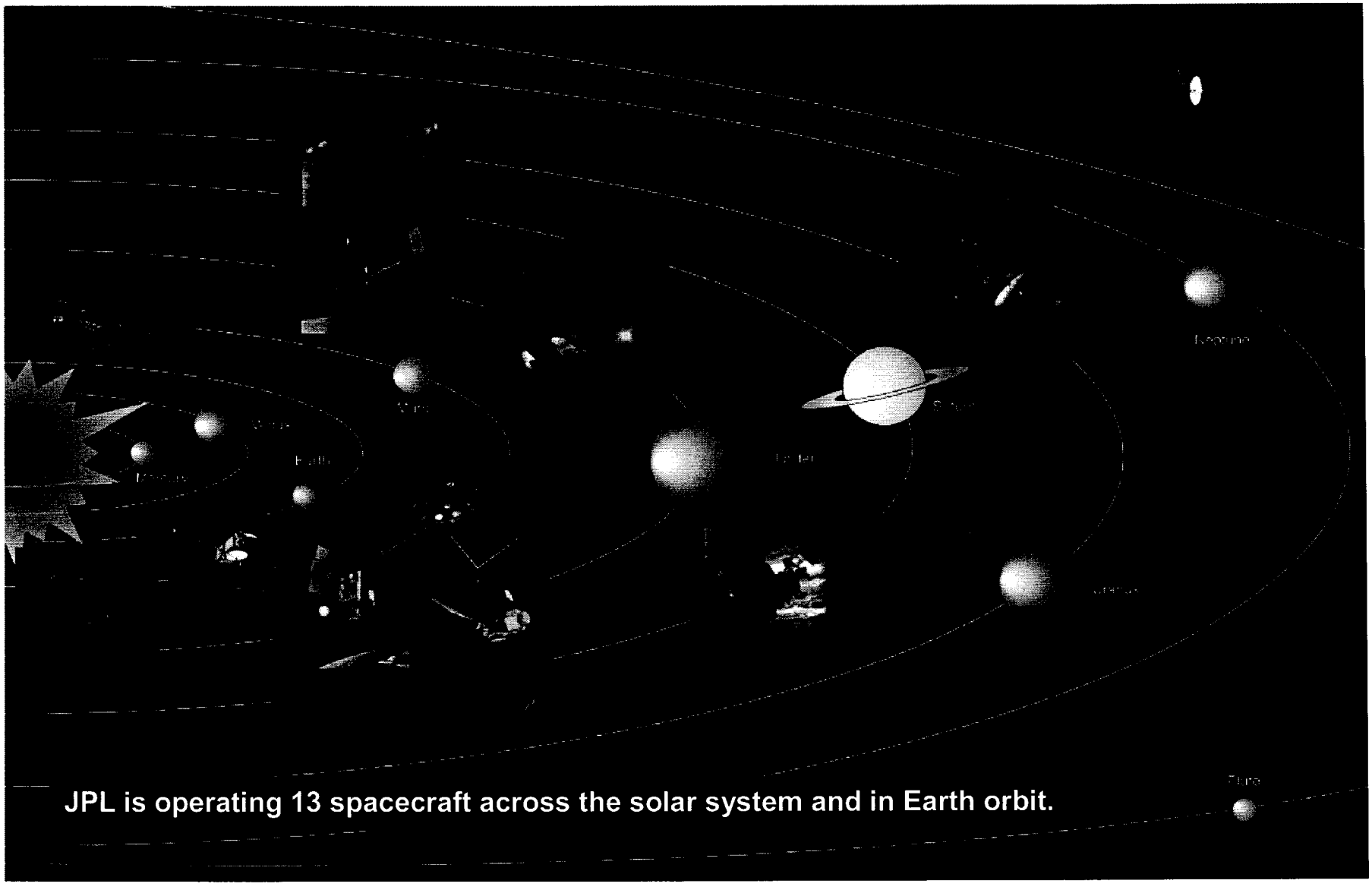
Operating Missions



JPL is operating 13 spacecraft across the solar system and in Earth orbit.

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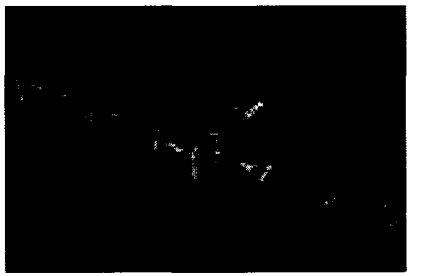
Future Significant Events

SIRTF Fall 2002

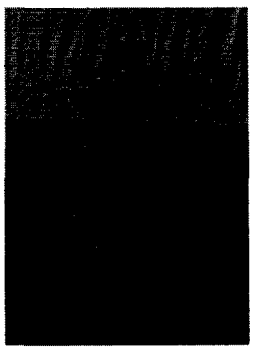
- GRACE launch 2002
- SeaWinds launch 2002
- GALEX launch 2002
- SIRTF launch 2003
- Rosetta Instruments launch 2003
- Microwave Limb Sounder launch 2003
- Thermal Emission Spectrometer launch 2003
- Mars Exploration Rover launches 2003
- Deep Impact Launch 2004
- Mars Exploration Rover landings 2004
- Stardust encounter 2004
- CloudSat launch 2004
- Cassini Saturn Orbit Insertion/Huygens Titan Entry 2004
- Genesis sample return 2004
- Deep Impact Encounter 2005
- Mars Reconnaissance Orbiter launch 2005
- StarLight launch 2006
- Stardust sample return 2006
- Mars Reconnaissance Orbiter MOI 2006
- Herschel launch 2007
- Planck launch 2007
- Mars Smart Lander launch 2009



Mars Reconnaissance Orbiter 2005

Mars Exploration Rover 2003

CloudSat 2004



Mars Smart Lander 2009

2002 2003 2004 2005 2006 2007 2008 2009 2010

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Description of the Commercial Technology and Regional Development Program at JPL

NASA Commercial Technology Goals

- Enhance NASA Enterprise activities
- Support NASA's national priorities and missions
- Contribute to the nation's technology innovation and readiness

JPL Goals

- Implement the NASA Commercial Technology Program goals at JPL
- Establish a growing role for the private sector in JPL's future
- Enable JPL to promote regional economic growth

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Best Producing Mechanisms

- Aggressive new technology identification and evaluation
- Aggressive licensing (through Caltech Technology Transfer Office)
- Strong outreach to industry regarding opportunities: JPL Commercialization Center
- Strong in-reach to technical staff to promote innovation
- Regional liaison and collaboration
- Reimbursable technology transfer (funded by companies)
- Collaborative technology development
- Partnership with companies in their proposals
- Strategic Alliances

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Commercial Opportunities for the Private Sector

- U.S. companies fund and use JPL technology
  - Licenses for patented technology
  - Expert assistance for un-patented know-how
  - Strategic Alliances for jointly developed technical thrusts
- U.S. companies acquire rights to use other JPL Intellectual Property
  - Copyrighted software, data, and images
  - JPL trademark and some mission trademarks
- U.S. companies can participate in JPL missions through funding
  - Technology demonstrations
  - Commercial demonstrations
  - Instruments/Subsystems
  - Outreach
  - Associated products

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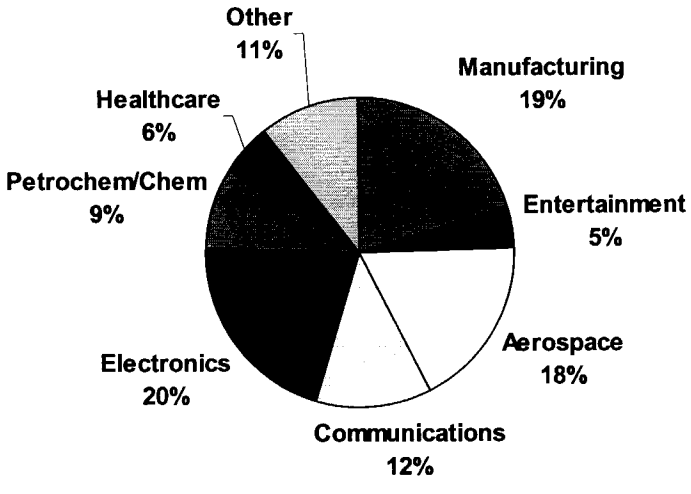
Overall Strengths of the JPL Commercial Program Office

- Experience with variety of companies and products
- A flexible set of "partnering" mechanisms
  - Letter of Intent
  - Memoranda of Agreement
  - Technology Affiliates Contract
  - Technology Cooperation Agreement
  - Strategic Alliances
  - Licensing of patents, copyrights, trademarks, and know-how
- Deep knowledge of technology and missions
  - Perform commercialization planning for missions
  - Perform technology evaluations
- Single point of contact for U.S. companies to JPL

Performance Metrics

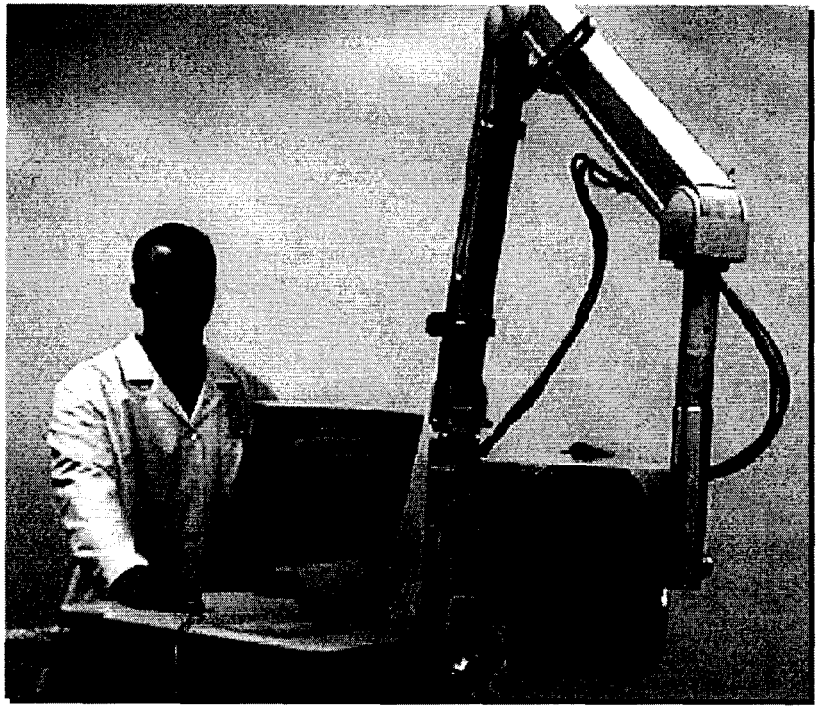
Metric	Average Value (Per Annum)
Innovations Reported	285
Patents Filed (Includes Provisionals)	91
Number of Partnerships Created	151
Reimbursable Funding	$6.6M
License Royalty & Equity	$500K-$1M

Reimbursable Tasks



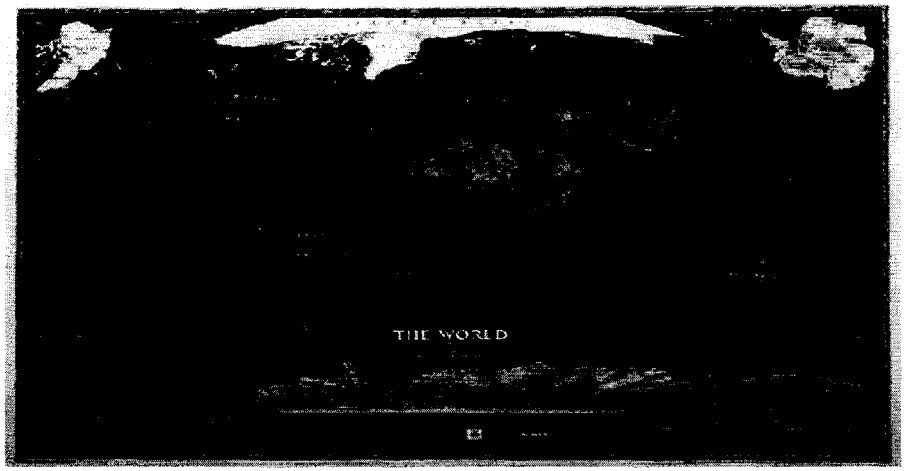
FY '99-00 Breakdown by Market of Reimbursable Tasks

Examples of Successful Technology Partnering and Commercialization with Industry



QWIP Based BioScanner for non-invasive breast cancer detection.

Examples of Successful Technology Partnering and Commercialization with Industry (cont'd)



The National Geographic Society provided a gift to America's children by sending every school in the United States a large, laminated, updated map of the world. Space program technology from JPL played a pivotal role in the creation of the satellite map images.

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Examples of Successful Technology Partnering and Commercialization with Industry (cont'd)

JPL and the Huntington Library, Art Collections, Botanical Gardens, San Marino, Calif., have joined forces to study micro-climates, placing sensor webs in the various specialized gardens at the Huntington. Such webs allow large areas to be monitored.

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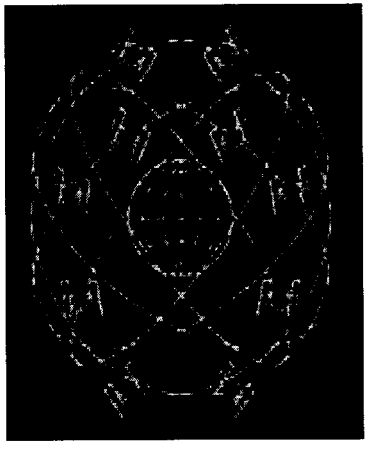
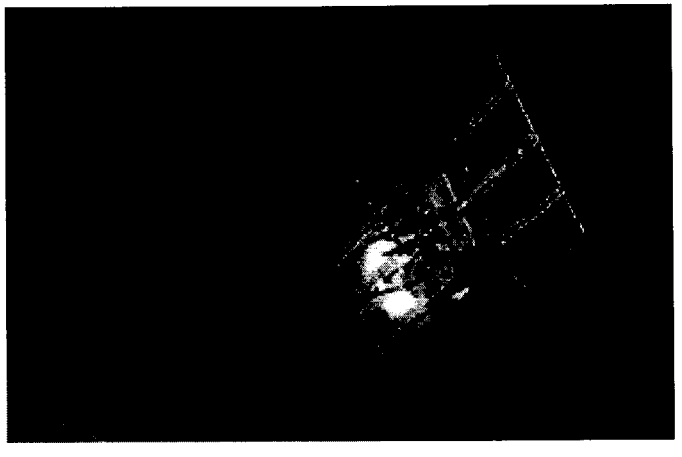
Examples of Successful Technology Partnering and Commercialization with Industry (cont'd)



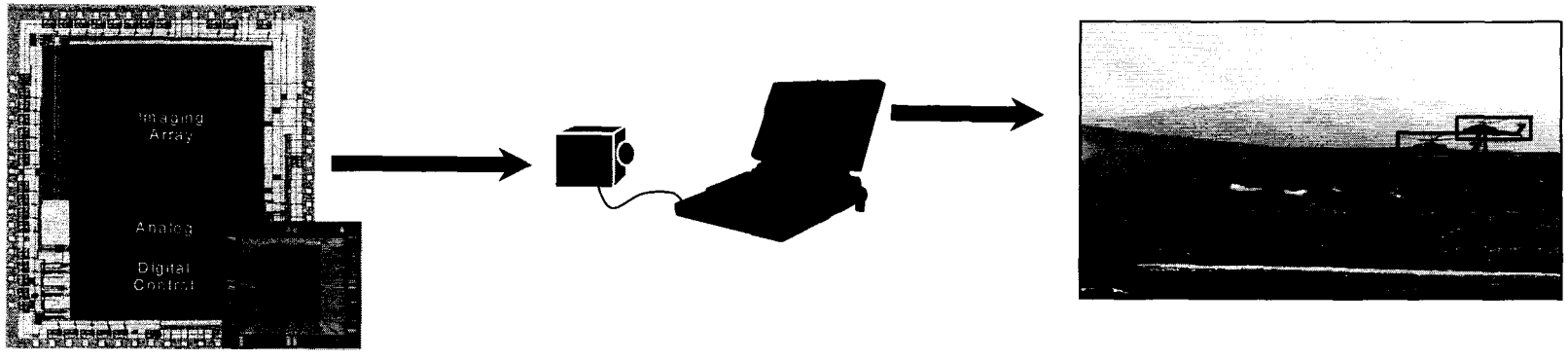


JPL is a leader in scientific application of Global Positioning Satellite data. Dubbs & Severino benefited from JPL's expertise in rapid accessing of GPS, and data fusion, to create a terrain avoidance system for small aircraft.

Examples of Successful Technology Partnering and Commercialization with Industry (cont'd)

The new microgyroscope was created out of a technology cooperation agreement between JPL & Hughes.

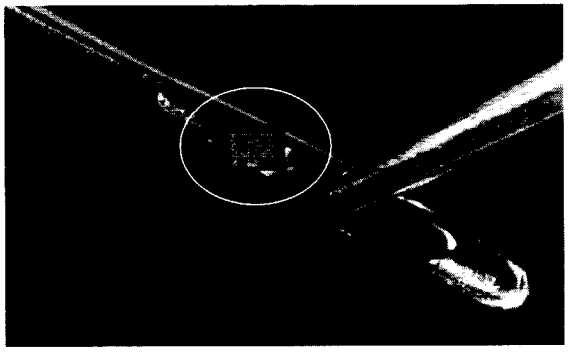
Examples of Successful Technology Partnering and Commercialization with Industry (cont'd)



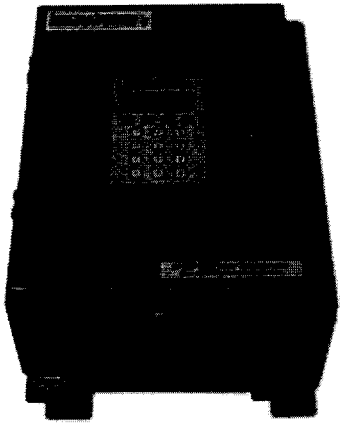
The Reconfigurable Multi-Resolution Imager System offers reduced bandwidth for surveillance and targeting applications. This success is based on JPL's CMOS Active Pixel Sensor.

Examples of Successful Technology Partnering and Commercialization with Industry (cont'd)

Tunable Diode Laser



Laser Gas Analyzer



A new commercial gas sensing product offers a compact highly reliable and highly sensitive gas sensor with no moving parts or consumables in addition to having low maintenance and calibration schedules.

Examples of Company Partners

Abbott Laboratories
Advanced Silicon Materials
AAE Systems
AEC-Able
AFES (Alternate Fluorocarbons)
Alfred E. Mann Foundation
Allen Osbourne Associates
Alliant Techsystems, Inc.
American Digital Imaging, Inc.
American Mobile Satellite Corporation
Amerigon, Inc.
Ametek
Analysis Consultants
Apple Computer
Applied Solar Energy (Tecstar, Inc.)
Astro Terra Corp.
B.F. Goodrich
Ball Aerospace
Ball Corporation
Barnes Engineering Co.
Boeing Computer Services
Boeing North American Rocketdyne Division
Bournes, Inc.
Breault Research Organization, Inc.
C. Visions
California Construction Consortium
Caremark International
Comsat Mobile Communications
Creare, Inc.
Datatape, Inc.
Displaymor Manufacturing
Dow Key Microwave, Inc.
DTI Energy, Inc. (Formerly DCT/Detroit Center Tool)
Dubbs & Severino
E Systems ECI Division
E-Lite Limited
Eaton Corporation
EG&G Reticon
Engelhard Sensor Technology
Equity Plus Investments Inc.
Far West Regional Transfer Center
FMC Corporation
Ford Motor Car Company
Gencorp Aerojet (Aerojet)
General Research, Inc.
Global Visions
Hamilton Standard
HPM Stadco
Hughes Aircraft Corporation
Hughes Missiles Systems
Hughes Radar & Communications
In-Situ, Inc.
Integ, Inc.
Intergraph, Inc.
International Telephone & Telegraph Corp.
Kraft General Foods
KVH, Inc.

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Examples of Company Partners (cont'd)

Leo One Corp.
Leybold-Inficon, Inc.
Litton Systems, Inc. (Aero Products Division)
Lockheed/Martin
Lockheed Missile & Space Co.
Loral Federal Systems Company
MKS
Manville Sales Corp.
Marlow Industries, Inc.
Martin Marietta Corporation (Astro Space)
McDonnell Douglas
Methyl Bromide Global Coalition
Mission Research Corporation
Mission Technology Corporation
National Center for Manufacturing Sciences
National Geographic TV
National Semiconductor
NAVSYS Corp.
Northrop Corporation
Omaha Steaks Corp.
Opti Comp Corp.
Opto Knowledge Systems, inc.
Orbital Sciences Corp.
Pacific Scientific
Pargain Technologies, Inc.
Perkin-Elmer Corp.
Perot Systems Corp.
Photobit
Physical Sciences, Inc.
Polatomic, Inc.
Printrak International
Programmed Composites, Inc.
Pulson Communications
Qualcomm Incorporated
Qualcomm Systems (SSL/Space Systems Loral)
Research Institute for the Management of Technology
Rockwell International (Avionics)
Rohm and Haas Company
Schlumberger Industries
Shiley Heart Valve Research Center
Southern California Gas Company
Space Computers Corp.
Space Electronics, Inc.
Space Systems/Loral
Stanford Telecommunications, inc.
Sundstrand Corp.
Sun Maid Growers of California
SunPower Inc.
Sy Technology, Inc.
Technology International, Inc.
Teledesic Corporation (Calling Corp.)
Thiokol Elkton Division
Three M Company (3M)
TRW, Inc.
Ultra Corporation
Vitesse Semiconductor Corp.
Walt Disney Imagingeering (WDI)